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Chapter 1: General Pharmacologic Principles

Answers to "Time for Review" Questions

1. Page 6

   Describe the process a new drug must undergo for approval. Several ethical, moral, and legal issues are implied in the preceding section on drug development. Can you expand upon them? Can you think of others?

   After a potential medication is tested on animals, it must undergo at least three and possibly four phases of human testing:

   1) Testing on healthy volunteers

   2) Testing on people with the disease the drug is expected to help

   3) Large multicenter trials

   4) Postmarketing surveillance.

2. Page 10

   What is the difference between a generic name and a brand name? What is the difference between an indication and a contraindication?

   A generic name is assigned by the United States Adopted Name (USAN) Council and is not owned by any company. A brand or trade name is a name registered with a pharmaceutical company that is producing and marketing the drug. Indications are clinical reasons to use certain drugs, and contraindications are situations in which the drugs should not be used.

3. Page 14

   What is the difference between an allergy and an ADR?

   An allergy is one of many types of ADRs.

4. Page 20

   If you were in pain, would you rather have a morphine tablet or solution? Why?

   I would rather have the morphine solution because the solution is already dissolved and thus would work faster than a tablet.

5. Page 23

   Why would patients with kidney disease or decreased kidney function, such as the elderly, be prescribed lower doses of a medication?

   Impaired renal functions can prolong the effects of medications because the kidneys are not as effective in eliminating the drug from the body.

6. Page 32

   Can you describe the six "rights" of medication administration?

   1) Right drug—Make sure it is the prescribed drug, and inform the patient.

   2) Right dose—Double-check if it is a calculated dose.

3) Right patient—Always check wrist tag. Confused patients may answer to someone else's name or be in the wrong bed.

4) Right time—Check and follow the prescribed schedule.

5) Right route—Check and follow the order. The wrong route can influence the speed of onset and duration of a drug's effect.

6) Proper documentation

Answers to Review Questions

1. (c) The fact that it is capitalized confirms that it is a trade name.
2. (c) Pharmacokinetics involves all these processes that happen with a drug when it is administered.
3. (e) All these factors could explain the confusion.
4. (d) Protein binding, fat, and water solubility all affect how a drug will be distributed within the body.
5. 1–b

   2–c

   3–e

   4–d

   5–a

6. The half-life ($T_{1/2}$) is the amount of time it takes for the concentration of a drug to decrease by half once administered within the body. Half-life is used to determine when a drug has reached its steady state and maximum concentration in the body.
7. a. Home care patient with severe nausea—Rectal

   b. Rapid onset needed in emergency—IV

   c. Patient is NPO—Rectal, IV, or IM

   d. Chronic respiratory inflammatory disease that requires corticosteroids that have many systemic effects—Inhalation

   e. Executive smoker trying to quit and needs nicotine replacement—Transdermal
8. pH is one factor that influences the bioavailability of a drug. Most drugs are weak acids or bases, and their ionization depends on pH. Drugs in the non-ionized form are absorbed through membranes, whereas ionized drugs are not. pH is different in the various parts of the gastrointestinal tract, and drugs that are more in the non-ionized form in low pHs, such as aspirin, are better absorbed in the more acidic stomach.
9. Agonists have affinity for a receptor and cause a response. Antagonists have affinity but do not activate the receptor and can thus block agonists.
10. Phase 1—Healthy human volunteers

    Phase 2—People with the disease for whom the drug is expected to work

Phase 3—Large multicenter trials

Phase 4—Postmarketing surveillance

11. Additive means combining two active drugs to have an effect equal to the total of the two individual drugs—mathematically: 1 + 1 = 2. Synergism means giving two active drugs together that have an effect greater than their sum effects—mathematically: 1 + 1 = 3. With potentiation, one drug is active and the other has no effect, but when given with the active drug, the other drug increases the effect of the active drug more than expected—mathematically: 1 + 0 = 3.
12. A drug allergy induces a hypersensitive reaction and is just one example of an ADR. Other examples of ADRs are headaches, tremors, and palpitations.

Chapter 2: The Metric System and Drug Dosage Calculations

Answers to "Time for Review" Problems

1. Page 40

   An IV solution of 1,500 ml is equal to how many liters?

   1,500 ml = 1.5 liters

2. Page 40

   What are some of the advantages of the metric system?

   The metric system has a number of advantages, including the following: It is the choice measuring system used outside the United States, England, and respective territories; it is the system used by drug manufacturers; and it is easier to use than other systems because it is based on powers of 10, and converting within the system simply requires moving the decimal point.

3. Page 43

   A quart of blood is equal to how many milliliters?

   $$\frac{1 \text{ quart}}{1} = \frac{1 \text{ liter}}{1.06 \text{ quarts}} = .93 \text{ liters which equals } 943 \text{ milliliters.}$$

4. Page 47

   You have a 10% drug solution on hand, and the order states to deliver 100 milligrams of drug. How many milliliters would you deliver?

   $$\text{Given } 10\% \text{ drug solution} = \frac{10 \text{ grams}}{100 \text{ ml}} = \frac{100 \text{ mgs}}{x \text{ ml}}$$

   $$\frac{10{,}000 \text{ mg}}{100 \text{ ml}} = \frac{100 \text{ mg}}{x \text{ ml}}$$

   $$10{,}000x = 10{,}000$$

   $$x = 1 \text{ ml}$$

Answers to Review Questions

1. (b) Because the metric system is based on powers of 10, it is easy to work with.
2. (c) A pound is a measurement in the English system.
3. (a) 1 cc = 1 ml
4. (d) Height and weight are used to determine total body surface area.
5. (b) The w stands for the powdered drug, and the v represents the final solution.
6. 3.2L = 3200ml

7. $175\text{ lb} = \frac{1\text{ kg}}{2.2\text{ lb}} = 79.54\text{ kg}$
8. 3lbs = $\frac{1\text{kg}}{2.2\text{ lbs}} = 1.36\text{kg}$
9. Converting the infant's weight to kilograms: 500 grams is equal to 0.5 kilograms. The order reads 200 mg/kg; therefore, you would give 200 mg x 0.5 kg or 100 mg. Since you have a solution containing 80 mgs per 1 ml, you would set up the following proportion: 80/1 = 100/x and x = 1.25 ml
10. $0.1\% = \frac{.1\text{ gram or }100\text{ mg}}{100\text{ ml}} = \frac{x\text{ mg}}{6\text{ ml}} = 6\text{ mg}$
11. 500cc = 0.5L
12. 8 milligrams
13. $\frac{336\ mcg}{42\ mcg} = 8\ puffs$
14. $\frac{1\text{ gram to }1000\text{ mg}}{200\text{ ml}} = \frac{\text{x mg}}{4\text{ cc or ml}} = 20\text{ mg}$

Chapter 3: Pharmacology of the Autonomic Nervous System

Answers to "Time for Review" Problems

1. Page 54

   What branch of the nervous system controls digestive actions?

   The autonomic nervous system controls peristalsis and digestive actions and represents the involuntary part of the peripheral nervous system that we have little control over.

2. Page 56

   Have you ever heard the saying, "That made the hairs on the back of my neck stand up"? Would you consider this a sympathetic or parasympathetic response, and why?

   This is a sympathetic response because it is in response to a stressful situation in which hair muscles contract, causing the hairs to stand on end.

3. Page 61

   Identify where nicotinic and muscarinic receptors can be found in the parasympathetic and sympathetic nervous systems.

   Nicotinic receptors are found at the preganglionic junctions of both the sympathetic and parasympathetic systems. They pass the signal on to the postganglionic neuron. Muscarinic receptors are found at the postganglionic junction in the parasympathetic system on glands or on smooth or cardiac muscle.

4. Page 62

   State the effects on the heart, blood vessels, or lungs from stimulating the following receptors: alpha, $beta_1$, $beta_2$, and muscarinic.

   Alpha receptors are primarily found in the smooth muscle of blood vessels. When stimulated, they cause vasoconstriction. $Beta_1$ receptors are primarily found in the cardiac muscle. When stimulated, they increase the rate and force of contraction of the heart. $Beta_2$ receptors are primarily found in the smooth muscle of the airways and vessels. When stimulated, they cause bronchodilation and vasodilation, respectively. Muscarinic receptors are in the parasympathetic system. When stimulated, they slow the heart rate and cause bronchoconstriction.

5. Page 64

   Which of the four autonomic categories can cause bronchodilation? Which can cause a decrease in heart rate?

   Bronchodilation would be caused by sympathomimetics and parasympatholytics. Parasympathomimetics and sympatholytics would cause the heart rate to slow.

6. Page 65

   Differentiate ACh and AChE. Now relate these terms to direct- and indirect-acting agents.

Acetylcholine (ACh) action is terminated when metabolized by the enzyme Acetylcholinesterase (AChE). ACh can be increased by either giving agents increasing production of ACh (direct) or by agents inhibiting the enzyme AChE that breaks it down (indirect).

7. Page 68

   Contrast the mechanisms of neurotransmitter inactivation in the parasympathetic and sympathetic nervous systems.

   Acetylcholine action in the parasympathetic system is terminated when metabolized by AChE. The neurotransmitter for the sympathetic nervous system (NE) is recycled back (reuptake), and the excess is metabolized by the enzymes MAO and COMT.

Answers to Review Questions

1. (d) The somatic, parasympathetic, and sympathetic nervous systems all lie outside the central nervous system and thus comprise the peripheral nervous system.
2. Fight or flight – S

   Digestion – P

   ACh at preganglion – B

   NE – S

   ACh at postganglion - P
3. c, a, d, b

4. (d) Stimulating the sympathetic (sympathomimetic) nervous system and blocking the parasympathetic (parasympatholytic) nervous system both cause bronchodilation.
5. (d) An example of a skeletal muscle would be the diaphragm. Blood vessels and airways contain smooth muscle, and the heart contains specialized cardiac muscles.
6. The sympathetic nervous system is the fight-or-flight system, and it responds to stressful situations. The parasympathetic nervous system controls the day-to-day bodily activities, and it is necessary to maintain the body. These systems work in opposition to each other.
7. The peripheral nervous system is composed of all the nerves outside the brain and spinal cord. Sensory information is carried via afferent nerves from all parts of the body to the brain. The brain sends motor information via efferent nerves to have effects on various parts of the body.
8. $Beta_2$-receptors are found in airway smooth muscle and certain blood vessels. When stimulated, they cause bronchodilation and vasodilation. $Beta_1$-receptors are primarily found in cardiac muscle. When stimulated, they cause an increase in heart rate and force of contraction. Alpha-receptors are found in smooth muscles of blood vessels. When stimulated, they cause vasoconstriction. $Beta_2$ inhibition blocks the normal $beta_2$ response, thus causing bronchoconstriction and vasoconstriction.
9. Anticholinergic responses include pupil dilation, bronchodilation, and increased heart rate and force of contraction.
10. Adrenergic responses consist of pupil dilation, bronchodilation, and increased heart rate and force contraction.